CALIFORNIA ENERGY COMMISSION
1516 Ninth Street
Sacramento, California 95814

Main website: www.energy.ca.gov

PROGRAM OPPORTUNITY NOTICE

ANNOUNCING THE RELEASE OF A
COMPETITIVE GRANT SOLICITATION AND APPLICATION PACKAGE
FOR

Advanced Heavy Duty Natural Gas Engine Research & Development

PUBLIC INTEREST ENERGY RESEARCH PROGRAM
PON-08-009

Release Date: **January 22, 2009**

Proposal Due Date: **February 24, 2009 at 4:00 p.m.**

Purpose:
This is a competitive grant solicitation sponsored by the Energy Commission's Public Interest Energy Research (PIER) Program's Transportation Subject Area to accelerate research and development of advanced natural gas engine concepts for application in heavy-duty vehicles, operated in fleets throughout California.

California leads the nation in its effort to promote clean alternative technologies, mitigate the effects of climate change, reduce petroleum dependency, and reduce greenhouse gas (GHG) emissions to improve the state's economy and the protection of public health and the environment. Energy consumed by, emissions produced from, and the economic impact of the transportation sector have been the subject of study and recent action by the executive and legislative branches of California government - setting goals to reduce petroleum consumption[1] and the production of GHGs.[2] The use of alternative fuel vehicles (AFVs) is seen by the State of California as a critical element in programs directed at achieving these goals.[3]

Both compressed natural gas (CNG) and liquefied natural gas (LNG) offer near-term potential to serve a larger share of the vehicle market if certain performance and technical barriers can be overcome. The natural gas vehicle (NGV) industry has grown

[1] The State Alternative Fuels Plan (December 2007 CEC-600-2007-011-CMF) developed to fulfill the requirements of California Assembly Bill 1007 calls for a reduction in the consumption of petroleum of 15% by 2020 with a corresponding increase in alternative fuels to 30% of the on-road fuel market by 2030.
[2] The Governor's Executive Order S-3-05 established goals to reduce statewide GHG emissions (to 1990 levels by 2020) that were later codified into law in Assembly Bill 32. Further, Executive Order S-01-07 established the first Low Carbon Fuel Standard (LCFS), the goal of which is to require fuel providers established to reduce the carbon intensity in fuel.
[3] AB 118 directs the Energy Commission and the Air Resources Board to transform California's transportation sector by reducing petroleum use, and among other strategies, using alternative fuels such as natural gas.

steadily over the last two decades, but is still focused on a few early market sectors and lacks the scale to sustain continued research, development, demonstration, and deployment (RDD&D) necessary to compete with the rapid advance of diesel engine technology. Natural gas is lower in cost, compared to diesel fuel, and NGV engines can achieve lower emissions of criteria pollutants and GHGs. An analysis in the State Alternative Fuels Plan shows a potential for GHG reduction (11-23%), however a loss of efficiency precludes industry from business decisions leading to market expansion of NGVs for on- and off-road heavy-duty technologies. Improvements in NGV heavy-duty engine fuel efficiency, particularly in part load operating regimes, must be achieved if natural gas is to reach its potential to contribute toward these public policy objectives.

During 2007 and 2008, the Energy Commission conducted an in-depth analysis of the challenges and technology research gaps associated with natural gas engines, vehicles, and fueling systems.[4] The Natural Gas Vehicle Research Roadmap identifies the gap between the performance of a natural gas heavy-duty engine and a similar diesel engine in the same vehicle application. Conventional spark-ignited natural gas engines have two fundamental deficiencies - increased fuel consumption and reduced power density - that hinder their ability to compete with diesel engines despite the lower price of natural gas. Therefore:

- RDD&D is needed to improve the operating fuel efficiency of heavy-duty natural gas engines.[5]
    - Historically natural gas engines, which use a throttle to control engine speed and a spark to ignite the fuel, exhibit poor fuel economy in part-load operation when compared to diesel engines. Diesel engines autoignite the fuel injected into highly compressed, high temperature, unthrottled intake air.
    - Despite the price difference between natural gas and diesel fuel that favors natural gas, the reduced efficiency of natural gas engines (especially at part-load operation) reduces the fuel cost savings, lengthening the time period needed to recover higher initial costs, and inhibiting market adoption.
    - Because greater fuel cost savings are needed to offset the higher cost of a natural gas vehicle, improving fuel efficiency at part-load operation will enhance the market competitiveness of NGVs. This is especially true for urban applications where a vehicle may operate for extended periods at part load.
- RDD&D is needed to improve the power output of natural gas engines.
    - Current spark ignition natural gas engines have a power rating 10%-20% lower than their diesel counterparts at the same displacement.
    - Due to this lower power density, additional engineering and testing is required to integrate a larger natural gas engine into the chassis of a heavy-duty vehicle designed for a smaller diesel engine. These integration requirements increase the price differential between NGVs and diesel

[4] California Energy Commission 2008. *Natural Gas Vehicle Research Roadmap*, CEC-500-2008-044D
[5] IBID page 19

vehicles and present a barrier to the implementation of natural gas engines into new applications.

- RDD&D to lower the incremental cost of CNG or LNG vehicles.
    - CNG and LNG vehicles typically have a higher cost than the diesel counterpart; however, technology or manufacturing improvements that materially reduce this higher cost may offer a significant near term and long term market expansion.

Eligible Projects:
Promising technologies that improve fuel efficiency and may also improve the power density of heavy-duty natural gas engines - through new advances in combustion and/or engine control technologies - will be considered for this competitive grant solicitation. Candidate concepts include (but are not limited to): cylinder deactivation, advanced controls, multi-port injection, direct injection, combustion chamber optimization, and cool-combustion technologies. Proposals that demonstrate an opportunity to lower production cost of CNG or LNG engines or vehicles will also be considered.

Eligible projects should seek to maximize realized benefits (that is, a reduction in energy consumption and GHG emissions) by:

- Targeting lowering cost of components for CNG and LNG engines.
- Targeting engines for OEM (original equipment manufacturer) vehicle applications that have a significant presence in California fleets.
- Targeting high fuel use heavy-duty fleet applications and market sectors, including those that are not currently using natural gas, both on-road and non-road.
- Proposing concepts that offer significant reduction in fuel consumption relative to conventional NGV heavy-duty engines.
- Developing an “intelligent” engine that operates with maximum efficiency under a wide variety of conditions. This can provide twofold benefits:
    - Efficient operation at part load operation;
    - Much more capable control systems, with the capability to adjust to a range of fuel properties (such as biogas, propane, imported LNG, or hydrogen blending), can enable penetration into wider markets worldwide. Penetration into wider markets can bring production scale economies to improve competitive pricing.
- Proposing technologies that can be broadly applied to different heavy-duty NGV engines, with a variety of power levels, and implemented into a variety of vehicle applications.
- Providing market-competitive driving characteristics, while minimizing performance compromises.
- Exceeding applicable Air Resources Board (ARB) heavy-duty on-road emission certification requirements.
- Assuring high likelihood of bringing beneficial products to market by:

- Having a project team capable of successfully implementing the new technologies in California and able to adequately support the needs of the California market;
- Having a clear and risk mitigated business plan and commercialization approach and pathway.

Proposed research projects must include either (1) development and prototype testing of advanced concepts for later product development or (2) the development of engine components and systems for near-term market introduction. The focus of this solicitation is advanced engine development, so funding is not available under this program for the development of ancillary systems (a hybrid drive, for example). It is important to understand that the inclusion of ancillary systems would not result in the rejection of a proposal, as long as funding for the development or integration of these systems is provided elsewhere. Vehicle development and demonstration programs will not be funded under this solicitation, but may be the subject of a future solicitation.

NOTE: For this solicitation, heavy-duty vehicle is defined as Class 4 (Gross Vehicle Weight Rating exceeding 14,001 lbs.) and above.

Eligible Applicants:

This is a competitive solicitation seeking vehicle and engine manufacturers, and technology developers and teams who have demonstrated expertise and experience with the development of advanced engine concepts, control systems, and products. To be eligible, applicants must present a team with demonstrated development, testing, and commercialization capabilities (bringing new engine and transportation technologies to the market and supporting the ultimate customer). Both private and public entities may apply.

California business entities as well as non-California business entities conducting intrastate business in California are required to register and be in good standing with the California Secretary of State to enter into an agreement with the Energy Commission. If not currently registered with the California Secretary of State, Applicants are encouraged to contact the Secretary of State's Office as soon as possible to avoid potential delays in beginning the proposed project (should your application be successful). For more information, contact the Secretary of State's Office via their website at www.ss.ca.gov.

Funding Information:

Up to **$2.7 million** of FY 2007/2008 PIER Natural Gas funding is available for PIER project funding through this solicitation with the possibility of additional funding from related program sources. The Energy Commission anticipates selecting two to three projects for funding.

No single proposal may request funding for more than $1,000,000. Organizations may submit multiple proposals; however, each proposal must be distinct, separate projects, and must be submitted separately adhering to all requirements contained in this solicitation.

Match funding for this solicitation is encouraged but not required for selection.

Schedule of Proposal and Award Process:

Release of Program Opportunity Notice	January 22, 2009
Pre-Proposal Workshop (via in person participation, teleconference, WebEx) Hearing Room A 1516 Ninth St., Sacramento, CA 95814	February 3, 2009 10:00 to 12:00 Noon See Public Participation Instructions (page 15)
Deadline to Submit Questions	February 6, 2009
Post Questions and Answers to Website	*Estimated* February 13, 2009
Deadline to Submit Proposals	**February 24, 2009** **4:00 p.m.**
Interview Applicants (if necessary)	March 9-13, 2009
Post Notice of Proposed Award	*Estimated* March 24, 2009
Approval of Awards at Energy Commission Business Meeting	*Estimated* May – June 2009

Please see the full Application Package for more information.

Availability of Solicitation Documents and Information:
This solicitation and all supporting documents and forms can be found at http://www.energy.ca.gov/contracts/index.html under "Current Solicitations." Interested parties may also register on the electronic mailing list on this webpage to receive notifications of any changes to this solicitation.

For those parties without internet access, copies of solicitation documents and information can be obtained by contacting:

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In addition, you may request to be added to the mailing notification list to receive changes made to this solicitation.